

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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PCT

NOTIFICATION OF TRANSMITTAL OF
INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing
(day/month/year) **06 NOV 2003**

Applicant's or agent's file reference

100325.0200PCT

IMPORTANT NOTIFICATION

International application No.

International filing date (day/month/year)

Priority date (day/month/year)

PCT/US03/04376

12 February 2003 (12.02.2003)

17 December 2002 (17.12.2002)

Applicant

FLUOR CORPORATION

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US

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Duane S. Smith

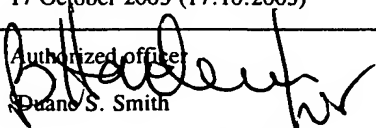
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 325.0200PCT		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US03/04376	International filing date (day/month/year) 12 February 2003 (12.02.2003)	Priority date (day/month/year) 17 December 2002 (17.12.2002)	
International Patent Classification (IPC) or national classification and IPC IPC(7): B01D 53/14 and US Cl.: 95/235,236,237			
Applicant FLUOR CORPORATION			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>4</u> sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand 08 September 2003 (08.09.2003)		Date of completion of this report 17 October 2003 (17.10.2003)	
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230		 Authorized officer Duane S. Smith Telephone No. 703-308-0651	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US03/04376

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description:
pages 1-17 _____ as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☒ the claims:
pages NONE _____, as originally filed
pages 18-21 _____, as amended (together with any statement) under Article 19
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☒ the drawings:
pages 1-2 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☐ the sequence listing part of the description:
pages NONE _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US03/04376**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. STATEMENT**

Novelty (N)	Claims <u>1-20</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-20</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-20</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-20 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the claimed features of a gas treatment plant including a first absorber in which lean solvent absorbs carbon dioxide, hydrogen sulfide, and a hydrocarbon; a second absorber fluidly coupled to the first absorber in which at least part of the hydrogen sulfide is separated from the carbon dioxide; and a sulfur plant that receives the at least part of the hydrogen sulfide to produce a sulfur product and a tail gas, wherein at least part of the tail gas is hydrogenated and is recycled to the absorber nor a gas treatment plant including an absorber that receives a feed gas including carbon dioxide and hydrogen sulfide, a carbon dioxide saturated lean solvent and wherein the absorber produces an overhead stream comprising at least a portion of the carbon dioxide; and wherein the lean solvent is combined with the overhead stream and cooled to form the saturated carbon dioxide saturated lean solvent thereby increasing selective absorption of the hydrogen sulfide from the feed gas in the lean solvent nor a gas treatment plant including a solvent regenerator that receives from a plurality of absorbers a solvent comprising an acid gas and a hydrocarbon and that produces an overhead vapor; a separator that receives the overhead vapor and separates the acid gas from the hydrocarbon to form a hydrocarbon liquid; and a stripper that is fluidly connected to separator and fractionates the hydrocarbon liquid to produce a hydrogen sulfide depleted hydrocarbon product and a vapor comprising hydrogen sulfide that is fed to a sulfur plant, nor a gas treatment plant including an absorber that receives from a solvent regenerator a vapor including hydrogen sulfide and a hydrocarbon and that further receives a carbon dioxide depleted solvent including hydrogen sulfide and wherein the absorber produces a hydrocarbon depleted overhead vapor including hydrogen sulfide that is fed to a sulfur plant and hydrocarbon enriched bottom product that is recycled to the solvent regenerator, nor a gas treating method including contacting a gas with a first portion of a lean solvent to absorb at least one of a heavy hydrocarbon and heavy mercaptan from the gas into a first portion of the lean solvent; cooling the gas and contacting the cooled gas in an absorber with a second portion of the lean solvent to absorb at least one of a light hydrocarbon, a light mercaptan, and hydrogen sulfide into the second portion of the lean solvent, wherein the second portion of the lean solvent is saturated with carbon dioxide; contacting the gas exiting the absorber with a third portion of the lean solvent to saturate the third portion with carbon dioxide thereby forming a gas solvent mix; and cooling and separating the gas solvent mix thereby forming the second portion of the lean solvent that is saturated with carbon dioxide.

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus the instant invention industrial applicability because the subject matter claimed can be made or used in industry.

CLAIMS

What is claimed is:

1. A gas treatment plant comprising:
 - a first absorber in which a lean solvent absorbs carbon dioxide, hydrogen sulfide, and a hydrocarbon;
 - a second absorber fluidly coupled to the first absorber in which at least part of the hydrogen sulfide is separated from the carbon dioxide; and
 - a sulfur plant that receives the at least part of the hydrogen sulfide to produce a sulfur product and a tail gas, wherein at least part of the tail gas is hydrogenated and is recycled to the absorber.
2. The gas treatment plant of claim 1 further comprising a regenerator that is fluidly coupled to the first and second absorber, wherein the regenerator produces an acid gas, and wherein at least part of the hydrocarbon is separated from the acid gas as a hydrocarbon liquid.
3. The gas treatment plant of claim 2 further comprising a third absorber that receives at least part of the hydrocarbon liquid and in which residual sulfurous compounds are at least partially removed from the hydrocarbon liquid.
4. The gas treatment plant of claim 3 wherein the residual sulfurous compounds are fed to a sulfur plant.
5. The gas treatment plant of claim 1 wherein the second absorber is operated at a lower pressure and at a higher temperature than the first absorber such that that the carbon dioxide desorbed from the solvent in the second absorber has a purity of at least 90 mol%.
6. The gas treatment plant of claim 5 wherein the carbon dioxide is used for enhanced oil recovery or used as commercial product.

7. A gas treatment plant comprising:

an absorber that receives (a) a feed gas comprising carbon dioxide and hydrogen sulfide, (b) a carbon dioxide saturated lean solvent, and (c) wherein the absorber produces an overhead vapor comprising at least a portion of the carbon dioxide; and

wherein a lean solvent is combined with the overhead vapor and cooled to form the carbon dioxide saturated lean solvent, thereby increasing selective absorption of the hydrogen sulfide from the feed gas in the lean solvent.
8. The gas treatment plant of claim 7 wherein the absorber produces a bottom product that is reduced in pressure and heated to a temperature sufficient to desorb the carbon dioxide from the bottom product.
9. The gas treatment plant of claim 8 wherein at least a portion of the hydrogen sulfide in the desorbed carbon dioxide is absorbed in a second absorber using a portion of the carbon dioxide saturated lean solvent.
10. A gas treatment plant comprising:

a solvent regenerator that receives from a plurality of absorbers a solvent comprising an acid gas and a hydrocarbon, and that produces an overhead vapor;

a separator that receives the overhead vapor and separates the acid gas from the hydrocarbon to form a hydrocarbon liquid; and

a stripper that is fluidly coupled to the separator and fractionates the hydrocarbon liquid to produce a hydrogen sulfide depleted hydrocarbon product and a vapor comprising hydrogen sulfide that is fed to a sulfur plant.
11. The gas treatment plant of claim 10 wherein the acid gas is fed to an absorber in which a carbon dioxide depleted hydrogen sulfide rich solvent scrubs the acid gas.
12. The gas treatment plant of claim 11 wherein the scrubbed acid gas is fed to the sulfur plant.
13. The gas treatment plant of claim 12 wherein the sulfur plant produces a tail gas, and wherein at least part of the tail gas is hydrogenated and is recycled to at least one of the plurality of the absorbers.

14. A gas treatment plant comprising:

an absorber that receives from a solvent regenerator a vapor that comprises hydrogen sulfide and a hydrocarbon, and that further receives a carbon dioxide-depleted solvent comprising hydrogen sulfide; and

wherein the absorber produces a hydrocarbon-depleted overhead vapor comprising hydrogen sulfide that is fed to a sulfur plant, and a hydrocarbon-enriched bottom product that is recycled to the solvent regenerator.

15. The gas treatment plant of claim 14 wherein the carbon dioxide-depleted solvent is produced by another absorber that separates hydrogen sulfide from carbon dioxide using a carbon dioxide saturated lean solvent.

16. The gas treatment plant of claim 14 wherein a portion of the carbon dioxide-depleted solvent is fed to the solvent regenerator.

17. A method of treating a gas comprising:

optionally contacting a gas with a first portion of a lean solvent to absorb at least one of a heavy hydrocarbon and a heavy mercaptan from the gas into the first portion of the lean solvent;

cooling the gas and contacting the cooled gas in an absorber with a second portion of the lean solvent to absorb at least one of a light hydrocarbon, a light mercaptan, and H_2S into the second portion of the lean solvent, wherein the second portion of the lean solvent is saturated with carbon dioxide;

contacting the gas exiting the absorber with a third portion of the lean solvent to saturate the third portion with carbon dioxide thereby forming a gas solvent mix; and

cooling and separating the gas solvent mix, thereby forming the second portion of the lean solvent that is saturated with carbon dioxide.

18. The method of claim 17 wherein the step of optionally contacting is performed before the gas enters the absorber, and wherein the contacted gas is cooled before the contacted gas enters the absorber.

19. The method of claim 17 wherein part of the second portion of the lean solvent that is saturated with carbon dioxide is employed in another absorber as an absorbing solvent that removes hydrogen sulfide from a vapor.
20. The method of claim 19 wherein the another absorber is operated under conditions to reject carbon dioxide from the part of the second portion of the lean solvent.

Reg'd. PTO

05 APR 2005

10/532262

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/04376

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B01D 53/14
US CL : 95/235,236,237

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 95/235,236,237, 199; 423/228.229,220

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ✓	US 4,305,733 A (SCHOLZ et al.) 15 December 1981, Figs. 1-2, col. 6 line 65-col. 13 line 20.	1-20
A ✓	US 4,425,317 A (ZELLER et al.) 10 January 1984.	1-20
A ✓	US 4,372,925 A (CORNELISSE) 08 February 1983.	1-20
A ✓	US 4,242,108 A (NICHOLAS et al.) 30 December 1980.	1-20
A ✓	US 4,138,230 A (THOMPSON) 06 February 1979.	1-20
A ✓	US 4,080,424 A (MILLER et al.) 21 March 1978.	1-20
A ✓	US 3,989,811 A (HILL) 02 November 1976.	1-20

☐

Further documents are listed in the continuation of Box C.

☐

See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

10 June 2003 (10.06.2003)

Date of mailing of the international search report

08 JUL 2003

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